Group 30

Remote system monitor

ECS506U Software Engineering Group Project

Problem/Domain Analysis Report

Table of Contents

Introduction

Monitoring hardware and the processes running on it are essential tasks for system administrators, power users, and system builders, as they allow them to analyse a computer's state and troubleshoot problems when necessary. System monitoring programs like Task Manager, the pre-packaged software in the Windows operating system, allow you to view the applications and processes running on the system.

Our Domain

The application we are creating is a system and hardware monitoring program that will be used as an administrative tool by computer users to view and diagnose problems. The software will provide the current status of the hardware and details of running applications. This information will be provided remotely over the local network.

The Problem

Problem 1: Proper hardware monitoring

The existing task monitoring software provides a limited view of system information, and data pertaining to the system's physical hardware status, such as temperature or voltage, can only be accessed through alternate tools. This means that you would have to run two separate applications, and therefore create more clutter on the screen, if you wanted to simultaneously view information on both the system's running processes and the hardware.

Problem 2: Remote task management

Task management software does not currently provide an easy way to monitor or manage processes remotely from the host/local machine. For example, users running a full screen application with access to only one monitor are not able to view the system's processes or CPU utilisation without wasting time or screen real estate while the application is running. Even those who are likely to have more than one monitor, like system administrators and power users, may need to focus on other applications and other data, and would not necessarily want task monitoring software taking up screen space. A remote task management application would allow users to have the application running on a separate device, so they can access it when needed, without having to waste time or screen space.

Motivation and Solution

Our team will be creating an application that solves the problems listed above by bundling the functionalities of process management and hardware monitoring into one application. Although applications like Task Manager for Windows and Activity Monitor for MacOS primarily provide software details, and hardware monitoring programs only provide the status of the hardware, our application will provide both. This solves the first problem as both of these features can be used in tandem with each other, and both pertain to the hardware's current state.

In addition, the software we develop will be a web application which will allow the end-user to view tasks on a secondary device (i.e. phone or laptop). This will solve the second problem, as the user will not need to open the application and waste monitor space on their primary device in order to manage tasks. This may also allow analysis by other administrators to provide insight into issues and comparisons with other systems running the same or similar software, in order to assist with performance tuning.

How it Will be Made

This application will be a .NET Windows application implemented in C#, using ASP.NET as the server-side framework to create a dynamic web application. By using Windows and the .NET framework, we will have access to the Windows Management Instrumentation (WMI). This will allow us to access process and system information where needed. The web application will be run on the host machine on which you want to retrieve the information. The software will act as a web server, allowing locally connected devices to view details of the computer.

Customers and Users

System Administrators

A system administrator, also referred to as a sysadmin, is a user who works on maintaining the operation of a computer, a network of computers, or a network of servers. The system administrators regularly monitor computer systems to ensure problems are kept to a minimum and are solved quickly when they arise. Part of their job is to ensure the computer's resources are not being overallocated, and that the device is not running suspicious software.

A system administrator will find this software very useful as the web application format will allow them to view the processes currently running on a computer without having to connect to it remotely. A sysadmin may primarily use this software for process monitoring, or they may find it useful to be able to check the status and health of hardware components to ensure optimal performance and uptime. They will also be able to view, kill or start a process during troubleshooting steps or for security purposes (i.e. if known malware is caught running). Finally, they will be able to check the utilisation of the computer to ensure it is operating correctly.

System Administrator Traits:
- Good understanding of computers.
- Good grasp of current administrative tools readily available to them.
- Ability to grasp new tools to aid in monitoring and diagnosing problems within a computer system.

System Builders

A system builder is a user who builds a computer system. This can refer to hobbyists working on homebuilt computers, professionals building custom computers in original equipment manufacturer (OEM) companies, or PC technicians who provide technical support, build or upgrade PC equipment, and troubleshoot computers. Depending on skill level, they may also troubleshoot hardware problems and repair or replace components.

People who build computer systems will find both aspects of this software useful when it comes to testing the hardware of the computer as it will allow them to ensure everything is functioning correctly. When a computer is built, it may need to go through testing and verification to ensure the hardware is working as intended. This may be done though testing suites, such as the Intel Burn Test, to check that the CPU is functioning properly. Our software could be used to identify any potential problems and to ensure the processor is being properly utilised. Problems could be diagnosed by monitoring the clock speeds and thermals of the processor. In addition, system builders will be able to monitor each computer remotely on one device, instead of having to manually check each machine.

IT Technician Traits:

- Well-versed in how all computer components work; may be aware of expected performance and hardware monitoring statistics from each configuration.
- Understands how to use tools to monitor and diagnose problems easily.
- May regularly monitor hardware to check it's still working as intended.

Professional System Builder Traits:

- Understands how to correctly configure systems in both hardware and software.
- Has used tools to monitor hardware to ensure it is working as expected.
- May not spend much time testing or monitoring hardware.

Hobbyist Builder Traits:

- Has a basic understanding of how a computer works, including which components and software to use.
- May not easily grasp utility tools to check if the system is working as intended.
- Will spend more time with the hardware.

Power Users

The two aforementioned users may also fall under this domain; however, this title covers users who may not work in the technology industry. A power user is someone who is knowledgeable of computers and understands more than the average user, but may not know what a system monitor is. Power users will understand and use more advanced tools, such as Task Manager or certain hardware monitoring programs, if they have encountered problems with performance.

Users who fall under this category may use this software personally rather than commercially. For example, video editors, graphic artists and some gamers could fall under this category, because they would value the screen space and time saved by not having to open a separate application on top of their work. They can use this software to view system information on an entirely different device and access it when needed without being put out of their workflow.

Professional User Traits:

- Should be well-versed in basic administrative tools and how to use them.
- Understands what tools to use and what to look for when troubleshooting a problem.

Knowledgeable User Traits:

- Understands how to troubleshoot a computer but may not know what to specifically look for.
- Wants to understand and look up the correct software or tool to monitor the system.
- May not be confident in using the software or may lack an understanding of some functionalities.

The Environment

We are focusing on desktop monitoring software as mobile phone users are much less inclined to care about individual services and hardware statistics. While there are existing software solutions in the same domain that run on a variety of environments, such as Unix and Windows, if you wanted to view tasks or monitor hardware on a single desktop machine, you would have to open two separate applications and view them on your desktop monitor.

In addition, although there are other software options on Windows, the software is more specialised and either just monitors processes or just monitors hardware. There is also software, such as PowerAdmin, that can be purchased and is designed for monitoring a cluster of computers or servers, but this software may be overly complex.

Our Platform

Our focus will be on Windows monitoring and our software will run on Windows, but will be interfaced with via a web application. This means the host computer will run on a Windows environment and will provide the information to a web page where the system can be monitored. The monitoring interface will display monitoring details and allow the user to interact the processes. Any user with a device that has a browser connected to the local network can remotely use this software.

Justification

Our primary audience will be more Windows inclined, so we will focus on the majority for the first version of our software. For example, System Administrators will have SSH for monitoring Unix systems remotely, but Windows is less autonomous in remote tasks. This is especially true for certain editions, such as Home, which does not natively support remote desktop. System builders are much less likely to be building Linux machines, and power users on Windows are more likely to care about hardware monitoring as they are more likely to have a custom computer.

Another benefit of using Windows is that we will be provided with frameworks and interfaces to create our application. To start, Microsoft Windows supports the .NET framework which allows for integration with ASP.NET. This will be used to create our dynamic web page. WMI will allow us to get the process and system details of the machine. ASP.NET will use C# for the dynamic portions of the web application, such as getting the processes and hardware information. The language C# was chosen as it is syntactically very easy to read and understand, in addition to being structured similarly to Java. The website will also use HTML and CSS for displaying the content on the page that C# has generated.

On the client side, any modern browser will be able to access the web application that was created from the host.

We decided to make this application web based, because we felt there was a gap in the market for this type of software for small scale distributions, where the user is viewing one or a few computers. This makes the software more useful and more productive, as they can use a separate device for monitoring.

Tasks and Procedures Currently Performed

Process Monitoring

Process monitoring shows a grid of all the processes running on the computer. The user can then select processes and sort the grid based on a desired column, typically in ascending or descending order. This task would be used frequently by a system administrator, IT technician, professional user, and possibly a knowledgeable user to view currently running tasks and diagnose problems.

Kill Process

Each process shown in the process monitor will be selectable and, in turn, killable. When a process is selected to be killed, it will be removed from the grid and killed on the host machine. System administrators and IT technicians will use this feature, as they will have the necessary knowledge to understand which processes should be running and which processes could be causing problems.

Launch Process

Currently, system monitoring suites don't typically support this task; processes are launched manually using the graphical user interface (GUI) or over the command line. We will offer functionality for applications to be launched remotely from the web application by giving the path and name of the executable file. The process will then be added to the list of running processes within the grid. System administrators will find this utility helpful, as they most likely know where software is installed. In addition, this will give them the ability to kill processes and relaunch them.

Hardware Monitoring

Under most software suites, this would be a separate application; however, we will bundle it in with the software. These tools provide system statistics, such as CPU temperature, current frequency, voltage being supplied to the processor and more. It may also provide system information such as the CPU model and installed memory. While it may be of use to most users, system builders will find this tool especially useful. A hobbyist builder might have overclocked the system, so may want to monitor the voltage being applied at certain loads. A professional builder or IT technician may want to ensure clocks/performance is being met, and that temperatures are within their spec. A knowledgeable user may want to look at the type of components installed and check if components are operating correctly.

System Logging

A new task in this software is the ability to log both processes and hardware sensors if any problems arise. These problems may include an application using a considerable amount of system resources, such as CPU or memory. It could also produce warnings about hardware sensors, such as if the CPU temperature is too high. This will allow a system demonstrator or IT technician to review the logs of possible problems within the system. A hobbyist builder or knowledgeable user would also find this feature helpful as it would warn them of potential problems and help with troubleshooting.

Remote Monitoring

Unlike other competing software, ours will work as a web application, which may change how tasks are currently performed by users. Instead of opening the application on your actual machine, you will instead have the option to view it on the host machine within the browser, or on a remote device. This may change how users do their tasks, as they will have the option to use a separate device.

Competing Software

Task Manager

Windows Task Manager is a pre-packaged application in the Windows operating system for monitoring and managing processes, and viewing basic information about your computer, such as CPU utilisation, speed, and memory size or allocation.

Advantages:

- Task Manager is a simple application, with a very modern design (from Windows 8 and later). It doesn't overly clutter the interface with unnecessary tools, and can separate foreground and background processes.
- Provides an option to show how much detail the application displays. It can be put into a 'fewer details' mode, where only running applications are displayed, with a single button for ending a task.

Disadvantages:

- Inadequate hardware monitoring tools. Only provides utilisation of hardware and the speed/frequency it is running at.
- Does not provide an option to access this application remotely or allow the user to monitor their machine from another device.

Process Explorer

Process Explorer is a Windows application developed by Sysinternals. This application specialises in detailed process monitoring and management, but is quite limited in other tasks, such as system monitoring.

Advantages:

- More processes are shown. For example, the system idle process which carries a process identifier (PID) of 0 is not shown under the process tab in Task Manager.
- Processes are shown in a foldable tree structure, allowing you to easily view the parent process of all processes.
- Processes are colour coded based on their type.
- Unlike other software, you have the ability to restart (kill and then launch) and suspend (stop but don't kill) processes, which can dramatically save time while troubleshooting.

Disadvantages:

- Interface design might be overwhelming as it shows more menus and buttons than other monitors, and the list of processes has more detailed information.
- Functionality of the application is very specific, as it doesn't contain many features not related to process monitoring.
- The user has to understand parent processes in order to find the location of an application.

Hardware Monitor

Hardware Monitor, commonly called HWMonitor, is a hardware monitoring program developed by CPUID. The program monitors and logs hardware information based on sensors of the components. This can include CPU frequency, temperature and voltage, GPU frequency and temperature, and fan speeds.

Advantages:
- Provides detailed statistics based on the hardware in the machine. Each sensor in all compatible components will be displayed, such as fan RPM, hard disk temperature, and power usage of the processor.
- It logs the current, minimum, and maximum recorded detail of each sensor.

Disadvantages:
- Does not provide any information about what the computer is currently doing; only the status of the hardware.
- Details can't be viewed remotely, thus the application takes up a lot of screen space to show a long list of sensors.

PowerAdmin Server Monitor

This software suite is a large server monitoring platform, developed by PowerAdmin to manage and monitor multiple machines remotely. It offers a huge range of features that aren't necessarily in the same domain as our solution or the other applications being compared. It does, however, provide both process and hardware monitoring functionality.

Advantages:
- Provides the ability to monitor both the processes of a machine and the hardware sensors.
- Ability to store the monitoring data in a database.
- Software is designed as a remote client, allowing you to access and monitor details of a machine remotely.

Disadvantages:
- This software is designed for the enterprise market, meaning it is designed to monitor a whole network of computers, not a few. This makes the software much more complex than necessary for a user who is not managing many machines.
- Due to its large feature set, the focus is not on the process monitoring tools. The currently running processes are simply listed along with their name or the file path and name of the process.
- The software is not free, as it is designed for companies.

Spacedesk

Spacedesk is a Windows application that allows a computer to extend or share its screen with another device in the same local network or connected via USB. This allows the host machine to have multiple displays, even though only one is physically connected, or another device can view the display of the host machine. This is a remote display application rather than a remote desktop application, as it does not have the ability to control the computer remotely.

Advantages:
- Allows all devices, with any operating system, to view the display of the host machine.
- User can choose their preferred process or hardware monitoring tools.

Disadvantages:
- Even though it has the ability to control the host machine through touch screen, most applications will be designed to support keyboard and mouse, making interaction harder within an application.

- Does not provide process or hardware monitoring features, thus meaning more applications will be needed on the host machine.

Domain Model